Running head: PREDICTORS OF NO-SHOWS & THE BENEFIT OF REMINDERS

U.S. Army – Baylor University Graduate Program in Healthcare Administration

Analysis of the Relationship Between Predictors of No-Show Appointment Behavior and the Benefit of Automated Patient Reminders

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14. ABSTRACT
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Abstract

Appointments that are not kept can potentially impact both the personal health status of the patient and the financial health of the Military Healthcare System. This report studied nine predictors of appointment non-adherence using both univariate and multivariate analyses to show which predictors have the greatest effect on patient appointment keeping behavior and the resultant benefit of automated telephone reminder technology. Univariate analysis revealed the following eight significant relationships with appointment keeping behavior: age, marital status, beneficiary category, Tricare Prime enrollment, proximity to the facility, branch of service, appointment day of the week and call to appointment interval. However, multivariate analysis revealed that age, beneficiary category, sponsors branch of service and marital status were the only variables that contributed to the statistical power of the predictive model, which produced an R^2 value of 0.011 ($p < .001$).

The study went on to find that implementation of an automated appointment reminder system yielded a statistically significant reduction in the overall clinic no-show rate. The reduction from 8.65% in FY00 to 7.60% in FY01 resulted in a X^2 (1) = 7.24, $p < .05$. This finding demonstrates the usefulness of this technology as a means for improving overall clinic efficiency.

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Introduction

As the Department of Defense struggles to optimize the Military Health System (MHS) to meet the changing demands placed on it by various stakeholders, many Medical Treatment Facility (MTF) commanders have attempted numerous initiatives to create greater efficiencies in the delivery of health services. Central to many of these plans is the need to manage the health of each served population through targeted primary care interventions. The goal has been and will continue to be, to provide accessible, quality healthcare while developing new ways to reduce overall MHS expenditures and create additional capacity.

Optimization of the MHS is not a new idea. However, in the past much of the effort was in the form of a decentralized meshwork of local or regional initiatives that lacked clear and measurable indicators of success. In March 2000, the Assistant Secretary of Defense (Health Affairs), and the Director of the TRICARE Management Activity, in conjunction with the Deputy Surgeons General, created the MHS Re-engineering Coordination Team to develop a multi-dimensional approach to System/Facility Optimization. The broad goal shifted from providing primarily interventional services to better serving beneficiaries through injury and illness prevention programs aimed at improving the health of the entire population while reducing demand for the more costly and less effective tertiary treatment services (U.S. Department of Defense [DoD], 1999).

Although much work has already been done, the majority of the focus has been on primary care and rightly so. Many of our Army MTFs have begun the work of optimizing their Primary Care clinics to meet specific guidance outlined in the Assistant Secretary of Defense (Health Affairs) memo entitled, “Policy to Improve Military Treatment Facility

(MTF) Primary Care Manager Enrollment Capacity" (Health Affairs, 2000). This memo suggests the enrollment of 1300-1500 beneficiaries enrolled per Primary Care Manager (PCM); 3.5 support staff; 2 exam rooms per PCM and 25 visits per day per PCM. Clearly the goal of this particular mandate is to provide continuity of care for the patient while ensuring each PCM has the needed resources to deliver timely, efficient healthcare services to a greater number of eligible beneficiaries (Health Affairs, 2000).

In an attempt to maximize output in providing primary care services administrators and clinicians have scrutinized appointment templates to reduce inefficiencies and better manage the demand for health services. Initiatives such as "Primary Care Manager by Name" and "Appointment Type Standardization" have shown promise to this end, but human factors such as beneficiary appointment non-adherence have hindered full optimization in the primary care arena. Appointments that are cancelled at the last minute, or simply, not kept, have a potential to impact both the personal health status of the patient and the financial health of the Military Healthcare System.

"The total costs directly associated with appointment non-adherence are difficult to measure because of the hidden costs of increased illnesses due to treatment delays" (Leirer, Tanke, and Morrow, 1992, p. 55). As Leirer suggests, a simple estimate can be achieved by multiplying the sum of the fixed annual costs for personnel, equipment, and clinic space by the annual percent of no-show appointments (Leirer et al., 1992). For illustrative purposes consider the following example highlighted in the table below:

Table 1

Clinic Annual Cost Illustration

Cost Category	Unit of Assignment	Individual Cost per Unit	Total
Primary Care Manager FTE	10	$100,000.00	$1,000,000.00
Support Staff FTE	35	$42,000.00	$1,470,000.00
Clinic Square Footage	3500	$10.00	$35,000.00
TOTAL FIXED COSTS			*$2,505,000.00*
15% No-Show Impact on FC			**$375,750.00**

In this example, if the clinic is underutilized by 15% annually, the fixed cost component is $375,750. Simple estimates such as this demonstrate the magnitude of the problem when fixed assets sit idle.

Although anecdotal evidence suggests that recent management initiatives have positively impacted the no-show rate and thus stimulated an increase in clinic efficiency, this study attempts to empirically show which independent predictors have the greatest effect on patient appointment keeping behavior and demonstrates the resultant benefit of deploying automated telephone reminder technology.

Conditions Which Prompted the Study

As the cost to provide care and the volume of care provided within the TRICARE network continues to rise, DOD has embarked upon a crusade to develop successful practice features within their inventory of MTFs that are designed to optimizing practice and physician efficiency. To this end, the executive leadership has focused significant effort on improving provider availability and MTF enrollment capacity within the primary care arena. In order to achieve this goal and enhance overall financial viability physicians must efficiently see as many patients as possible. When a patient fails to show for a scheduled appointment, the ability of the physician to practice medicine is severely limited, ultimately leading to an inability to recapture additional workload from the

TRICARE network of providers. The success of this optimization initiative, and to a greater extent the financial health of the MHS, will be greatly impacted by the MTF's ability to minimize no-show problems and ensure patients are waiting to see a doctor when he/she is available.

Problem Statement

Does a patient's characteristics (age, gender, marital status, beneficiary category, enrollment in Tricare Prime, enrollment DMIS identification code, sponsor's branch of service, appointment keeping behavior) or clinic scheduling procedure (appointment day of the week, call-appointment interval), accurately predict appointment non-compliance? And, does the use of automated patient reminder technology result in a statistically significant reduction in the no-show rate?

Literature Review

DOD's Primary Care Optimization initiative has two main goals. The first is to realign staffing and resources within the Direct Care System with the mission of the MHS. And second, is to optimize the effectiveness and efficiency of those resources to deliver the most health services to the greatest number of beneficiaries (U.S. DoD, 1999). If these goals are to be met, each hospital, and to a greater extent each clinic within each hospital, must be capable of managing capacity, demand, and patient access to the direct care system.

Capacity management involves matching available resources with the needs of the served population. In order for this function to be successful, the organization must first be capable of limiting fluctuations in provider/patient contact time. Many organizations have found this to be a daunting task given the increased amount of administrative

requirements placed on its staff of providers. The key is to determine which factors are controlled by beneficiary behavior and which are a result of self-inflicted operational inefficiencies. Once provider availability is known, the healthcare delivery entity must then determine the evidence based requirements of the population served. Also referred to as “demand forecasting,” this assessment will provide the foundation for aligning resources with preventive services aimed at maintaining a healthy population while reducing the reactive effect of illness-based medicine (U.S. Air Force Medical Operations Agency, 2000).

Information obtained through an evidence-based demand forecast will set the stage for sound demand management resulting in enhanced case management, health promotion, and prevention. In addition, and probably the most significant by-product of appropriate demand management is increased patient satisfaction resulting from greater patient access to the health delivery system (U.S. Air Force Medical Operations Agency, 2000). Developing and implementing an appropriate appointment-scheduling template will ensure the right resources are at the right place at the specific time the patient needs medical evaluation and treatment.

Many outpatient clinics have conducted a variety of experiments to determine which template is the most effective in optimizing capacity and meeting demand. This is a relatively new paradigm. “In the not too distant past, long intervals in appointment scheduling and even longer waits within the clinic were seen as something of a status symbol” (Murray and Tantau, 2000, p. 1). Many physicians saw this excess demand as a wealthy, future revenue stream that ensured financial viability of the practice. However, practices that bought into this philosophy soon realized significant frustration stemming

from high no-show rates, translating into lost income, lost opportunity as well as a general increase in patient acuity (Murray and Tantau, 2000).

Realizing the practice of filling the schedule with routine appointments and squeezing in urgent visits by double-booking had created a system that was not only frustrating to physicians but lead to deteriorating patient satisfaction, two alternative modalities were developed. The first model, referred to as the "carve-out model," divided the daily appointment template into two equal halves with the morning being dedicated to same-day urgent care appointments and the afternoon reserved for routine or wellness visits. The second, commonly known as the open or "advanced access model," reserved approximately two-thirds of the appointment day for patients wanting to see their physician regardless of any triage classification, while only the remaining third was set aside for booked appointments (Murray and Tantau, 2000).

Although most practices have adjusted their templates in an attempt to manage demand, increase productivity and build trust with their customers, many providers may inherently find it difficult to embrace the practice of complete and open access (Herriott, 1999).

Regardless of the scheduling template employed to improve clinic efficiency, one task remains salient to full clinic optimization and that is reducing and/or controlling for patient appointment non-adherence. Early studies have examined a variety of variables that impact appointment keeping behavior. For example, Finnerty, Mattie, and Finnerty (1973) showed decreased clinic waiting times improved appointment keeping behavior, while Turner and Vernon (1976) indicated appointment keeping rates improved by 30% to 70% as a result of either mailed or delivered reminders (Benjamin-Bauman, Reiss and

Bailey, 1984; also see Finnerty, Mattie, and Finnerty II, 1973; Turner and Vernon, 1976). In fact, the findings of Benjamin-Bauman et al. provided early evidence that a form of open access can positively improve the no-show rate. In this study two experimental groups were established. The first examined 337 patients from the Leon County Health Department Family Planning Clinic in Tallahassee, Florida, who had called to schedule an annual gynecological exam. From this sample, patients were scheduled for an appointment within either 7 days (one-week group) or 15-21 days (three-week group). Patient appointments were recorded as a "show" or "no-show" depending upon whether they made it into the clinic or not at the prescribed appointment time and date. The one-week group, consisting of 68 individuals, and the three-week group consisting of 269 individuals, had an average "show-rate" of 75% and 57% respectively. Eleven people assigned to the three-week group called to cancel their appointment in the first experiment. Chi square analysis of both groups revealed that a statistically significant difference existed between the show rates of each group, X^2 (1) = 7.46, $p < .01$ (Benjamin-Bauman et al., 1984).

To further examine the effects of appointment intervals on the show rates researchers conducted a second test on a sample of 192 patients calling the same clinic to schedule an appointment. In this experiment patients were assigned to either a next-day group (n = 78), a two-week group (n = 77) or a rejected-appointment group (n = 37). A coin toss determined which appointment interval was offered first to the caller. Again, utilizing Chi Square analysis the difference in the show rates for the next-day group (72%) and the two-week group (52%) achieved statistical significance at the $p < .05$ level, X^2 (1) = 6.47 (Benjamin-Bauman et al., 1984). Further comparisons of the

difference between the next-day group and the one-week group, and the two-week and three-week group were found not to be statistically significant (X^2 (1) = .19, p = ns). However, after combining the next-day group with the one-week group and the two-week with the three-week group the differences were significant, X^2 (1) = 13.26, p < .01 (Benjamin-Bauman et al., 1984). The findings from this study imply that no-show rates can be diminished by scheduling patients within one week of their call-request and provides strong evidence regarding the need to work down appointment backlogs.

The factors involved in patient no-show behavior can include a combination of physiological, emotional, logistical, cultural and socioeconomic factors that are quite often out of the control of providers. Nevertheless, there is evidence that suggests targeted management initiatives can significantly impact the no-show rate within a variety of clinic settings. For example, patient reminders represent another type of management initiative that has shown promise to this end (Khanna and Phillips, 2001). Over the years these reminders have taken many forms including postal mail-outs, person-to-person telephone contact and, most recently, automated telephonic messaging.

Various studies have been conducted in a number of different settings to determine the true impact of patient reminders on appointment-keeping behavior. Quattlebaum, Darden, and Sperry (1991) examined the effects of computer-generated mailed reminders for appointments made more than 7 days prior to the scheduled date in which randomly selected individuals were assigned to receive an appointment reminder. In this study those who received the reminder (n = 391) had a no-show rate of 10% compared to 19% for those in the control group (n = 432). The 48% reduction in no-show behavior for patients scheduling appointment within the University Pediatric Group

of South Carolina achieved statistical significance at p = .0002 (Quattlebaum et al., 1991).

Before the acceleration of technology, mailed reminders emerged as a least expensive alternative to person-to-person telephonic contact. However, as our ability to integrate technology has increased, so too has our ability to reach out to our customers. With the advent of automated patient reminders that have the ability to interface with existing patient scheduling software, medical practices can seamlessly update and adjust appointment schedules with minimal effort. The cost of this technology is measured in terms of created capacity, increased revenue and improved patient satisfaction.

The basic automated reminder system contains three major subcomponents that target three problem areas. These include appointment non-adherence, medication non-adherence and prevention non-adherence (Leirer et. al., 1992). Although many of these systems have unique characteristics, the basic capabilities are quite similar. For example, with the appointment reminder module the facility can send a prerecorded message as a friendly reminder regarding an upcoming appointment. After entering a unique identification code the patient can either decide to cancel, change, or confirm the appointment. Just as in the case of mailed reminders however, some messages never reach their intended recipient either because of an incorrect phone number or the person is simply unavailable. In addition, the effectiveness of the system is equally dependent upon the customer's ability to interact with the automated prompts and to remember their personal identification code (Hashim, Franks, and Fiscella, 2001).

Despite some obvious shortcomings automated patient reminder technology has emerged as a viable option to more conventional methods, partly because the same effect

on the no show rate can be achieved without hiring additional personnel. In a randomized controlled trial of telephone reminders within a civilian family practice clinic Hashim et al. achieved some startling results. Within the telephoned group (n = 479) the no-show rate was 19% while the not-telephone group (n = 424) the no-show rate was 26% (X^2 (2), p = .0065). In addition the study found that the cancellation rate within the telephoned group significantly increased, which in turn freed up more appointments for walk-in patients leading to greater clinic efficiency (Hashim et al., 2001).

The effectiveness of patient reminders has been studied in a variety of special service settings to include immunizations, mammography and disease management. The results of these studies have consistently shown a positive impact on the rate of appointments kept (Hashim et al., 2001). For example, one particular study showed the combined effect of both a mailed and telephonic reminder on the immunization rate within a health maintenance organization. In this study children were assigned to a letter and phoned group, letter only group, and telephone only group which achieved an immunization compliance rate of 58%, 44%, and 44% respectively. Those assigned to the control group, for which no reminder was given, achieved an immunization rate of 36% (Lieu, Capra, Makol, Black, and Shinefield, 1998). Although the potential increased morbidity in children not immunized is somewhat difficult to measure, it is easy to see that a positive return on investment can be achieved by HMOs willing to spend the extra time and money for this type of intervention.

Much of the recent literature published on demand management and appointment-keeping behavior has focused on intervention strategies aimed at improving appointment adherence and clinic optimization. These initiatives are not without merit, primarily

because there is so much room for improvement in the business aspect of delivering health care services. However, because of socioeconomic differences within the population served, continuity of care delivered, and scheduling methods, many of these strategies will vary in effectiveness across various clinic settings. Therefore, it is paramount that decision makers identify their enrolled population and learn as much as they can about them.

Identification of patient unique characteristics and no-show patterns has been shown to significantly aid in the development of appointment scheduling templates. Establishing the predictive value of these characteristics has allowed several clinics the opportunity to maximize resources to meet true demand. By adjusting schedules to anticipate the number of patients who miss their appointment, clinics have been able to achieve greater efficiency through demand forecasting (Dove and Schneider, 1981). In Dove and Schneider's study of 756 patients with scheduled appointments they found that patient's age, appointment interval, travel distance and previous no-show record were the strongest predictors of no-show behavior, achieving statistical significance at the .05 level (Dove and Schneider, 1981).

Lending further creditability to the predictive value of patient specific characteristics, Goldman, Freidin, Cook, Eigner and Grich (1981) found the predictive value of no-show behavior could be used to guide changes in scheduling templates or identify particular groups of patients for which targeted interventions may have a positive impact on behavior. In this study they found age ($p < .0001$), race ($p < .0001$), physician identified psychosocial problems ($p \leq .01$), and the previous appointment keeping

behavior ($p < .0001$) to be independently correlated with no-show behavior (Goldman et al., 1981).

As administrators and clinicians grapple with the best method for curbing the no-show rate within the outpatient arena, they must balance the financial goals of their practice, the demand for services, and the availability of providers in an attempt to optimize the efficient delivery of health services. Investigation and research into which independent variables have the greatest predictive value in determining the no-show rate will remain a germane issue facing the healthcare industry. Findings from evidence-based research will provide greater understanding of the population served and will aid administrators in arriving at the appropriate intervention (Gruzd, Shear and Rodney, 1986). Whether through "advanced-access" scheduling, patient reminders or appropriately overbooking appointments, research into which independent variables accurately identify the subset of the population that is most likely to miss an appointment will ensure these targeted interventions achieve their desired end state.

Purpose of the Study

The purpose of this study was to evaluate selected variables to determine which patient characteristics and scheduling practices accurately predict how many patients will keep their scheduled appointment. The independent variables being evaluated were: age, gender, marital status, beneficiary category, enrollment in Tricare prime, sponsor's branch of service, appointment day of the week (Monday through Friday), and call-appointment interval (days between the date an appointment was scheduled and the date of the appointment). The dependent variable is "appointment status" (show or no-show). The goal of this research endeavor was to determine the correlation between variables so

that the Family Medicine Clinic at Brooke Army Medical Center would be able to identify more accurately interventions aimed at improving appointment-keeping behavior. In addition this study examines the effectiveness of recently purchased patient reminder technology. The alternate hypothesis is: The identified variable(s) do have an effect on the no-show rate. The null hypothesis is: The identified variable(s) do not have an effect on the no-show rate.

Ethical Concerns

Patient and physician anonymity was maintained throughout this research endeavor. Information obtained from the Composite Health Care System (CHCS) and the Patient Administration Systems and Biostatistic Activity (PASBA) contained scrambled individual identifiers to ensure patient and physician privacy was protected.

Methods and Procedures

Information regarding clinic-scheduling procedures was evaluated using both the specific clinic template and aggregated CHCS ad hoc reports to ensure reliability and validity of the data. Patient specific encounter data was compared to both CHCS ad hoc queries and All Region Server (ARS) reports to ensure further consistency of the data file. Several hard copy patient records were also examined to ensure that reliability and validity of the dataset was maintained.

This research project examined all “show” and “no-show” data for the BGAA 4th level Medical Expense and Performance Reporting System (MEPRS) code, which is identified as Family Practice Care. Family Practice Care provides comprehensive examination, diagnosis, and treatment of inpatients and outpatients. It assists, provides, and evaluates the care of patients with a healthcare problem/concern including history

and physical, assessment and treatment of acute illnesses, ongoing management of chronic diseases, and counseling and teaching. Clinic appointments kept, as well as those registered as no-shows were analyzed from October 1, 1999 through September 30, 2000 (FY 00).

The Family Medicine Services Clinic has approximately 13,000 beneficiaries enrolled to its main clinic and approximately 7,000 at its satellite clinic (this estimate does not include a fluctuating student population that ranges from between three and five thousand). The number of providers available within the main clinic and satellite clinic varied depending on the time of the year and planned and unplanned operational requirements, in any event, the average number of available clinicians was approximately 20 and 13 respectively.

The study population consisted of all patient appointments at either of the two family medicine clinics of the Brooke Army Medical Center during FY 00. Both clinics are staffed with a combination of military and civilian family medicine doctors, physician assistants and nurse practitioners. Continuity of care is maintained through the establishment of provider panels, which averaged approximately 1,150 per primary care manager. The patient population served by this facility is comprised of active duty military service members and their dependents, retirees and their dependents as well as other identified beneficiaries entitled to healthcare services under Chapter 55, Title X, United States Code. The mean age of the active population (those individuals utilizing health services during the study) was 48.87 (SD = 17.57 yrs). Excluded from this study were those appointments cancelled prior to the scheduled appointment time either by the

facility (1,992), or the patient (5,596) and those classified as either sick-call or walk-ins (5,096).

The resulting eligible study population consisted of 38,553 scheduled patient appointments during FY 00. Of these, 35,484 (91.35%) resulted in the visit being made to the physician (show) and 3,069 (8.65%) resulted in a no-show. Each scheduled or no-show appointment was considered independently. Nine independent variables were identified. One dependent variable was identified. Descriptive and inferential statistics were calculated for each independent and dependent variable using the Statistical Program for the Social Sciences (SPSS). Standard univariate tests of association between the independent variables under study and appointment status (show vs. no-show) using X^2 and Student's t-test were performed. Those independent variables obtaining a significant F-ratio of less than .05 were then included in a multivariate analyses utilizing stepwise multiple linear regression in order to ascertain which independent variables provided the most utility in predicting no-show behavior. The standard error of the measurement was evaluated to determine the level of homogeneity between the measurement items. Finally, the validity of the model was assessed in terms of the correlation between the observed score and the true score by determining the degree to which the predictor adequately captured the relevant aspects of the criterion. Both content and construct validity were built into this model by focusing on sample characteristics consistent with those identified by Dove and Schneider (1981), Goldman et al. (1981), and Gruzd et al. (1986).

Following this analysis, the study then focused on the automated patient reminder system installed June 29, 2000. For the purpose of this study, the researcher contends that

in order to use the system effectively a short period of time was needed for full implementation of the technology. Therefore, the effectiveness of this intervention was measured by comparing the no-show rate from FY 00 to FY 01.

Coding

The first variable, patient age, was stratified into one of eight distinct categories. The second and third variables, gender and marital status, are dichotomous variables and were coded as 1 for male or 0 otherwise, and 1 for married and 0 otherwise, respectively. The fourth variable, beneficiary category is a nominal variable and therefore assigned to one of five groups (Active Duty Military, Dependent Active Duty Military, Retired Military, Dependent Retired Military/Survivor and Other). The fifth variable, enrollment in Tricare Prime, is a dichotomous variable, coded 1 for Tricare Prime enrollment and 0 otherwise. The sixth variable, residence within catchment area, is a dichotomous variable, coded 1 when the patient lives within the catchment area (service area), 0 otherwise. The seventh variable, sponsor's branch of service, is a nominal variable and assigned to one of five groups, Army, Air Force, Navy, Marine or Other. The eighth variable, appointment day of the week, is a nominal variable and was coded as 1 for Monday, 2 for Tuesday, 3 for Wednesday and so on. For the purpose of this study only appointments scheduled between Monday and Friday were considered.

Utilizing a separate dataset provided by the hospital's internal Composite Health Care System database, a separate ninth independent variable was considered in terms of its effect on no-show behavior in Brooke Army Medical Center's main family medicine clinic. This sample was collected for the same time period (FY00) and consisted of 14,819 scheduled and seen, and/or scheduled and no-show patient appointments. The

nominal variable, defined as the call to appointment interval (measured in days), was stratified into one of six groups. The classification of groups included a next day group (coded 1), 2-6 days (coded 2), 7-13 days (coded 3), 14-20 days (coded 4), 21-27 (coded 5), and a 28+ day group (Coded 6) (see Appendix A for complete codebook).

The dependent variable was the appointment no-show. Therefore each independently scheduled, non-cancelled appointment was examined to determine which independent characteristics have the strongest correlation with the dependent measure. This variable was coded as a mutually exclusive binary variable. If the patient arrived for his appointment it was coded as 1, 0 otherwise.

Results

After thorough analysis the researcher accepts the alternate hypothesis: "The identified variable(s) do have an affect on the no-show rate," and rejects the null hypothesis. A number of univariate relationships between the independent and dependent variables achieved statistical significance at or below the .001 levels. The patient demographic characteristics that revealed significant associations were as follows: patient age, X^2 (7) = 562.28, $p < .001$ (younger patients had a higher no-show rate), marital status, X^2 (1) = 29.97, $p < .001$ (single patients had a higher no-show rate), beneficiary category, X^2 (4) = 261.57, $p < .001$ (no-shows were more often the dependents of active duty military, followed by the military service member themselves), enrollment in TRICARE Prime, X^2 (1) = 8.39, $p < .001$ (no-shows were more often not enrolled in TRICARE Prime), residence within the catchment area, X^2 (1) = 19.77, $p < .001$ (no-shows more often lived outside the geographic service area), and sponsors branch of service, X^2 (4) = 110.15, $p < .001$ (no-shows were more often those individuals

authorized to receive care under Chapter 55, Title X, United States Code, but not directly tied to a military branch of service [i.e. Public Health Service or the National Oceanic and Atmospheric Administration]).

Analysis of the univariate relationship between patient/clinic scheduling characteristics revealed the following significant association at or below the .001 level: appointment day of the week, X^2 (4) = 24.34, $p < .001$ (no-shows were more often recorded on Friday), and in the second sample, call to appointment interval, X^2 (5) = 72.15, $p < .001$ (no-shows were more often the result of an appointment with an interval of greater than 2 days). The univariate relationship between appointment status and gender was the only association that did not achieve statistical significance at or below the .05 level in either of the samples studied (see Appendix B and C).

Stepwise, multiple linear regression of the eight independent variables on the dependent variable (Appointment Status: Show or No-Show) produced an R^2 value of 0.011 ($p < .001$). The variables contributing to the model were: patient age, beneficiary category, sponsors branch of service and marital status. Although this model only explains 1.1% of the shared variance between the identified dependent and independent variables, and fails to provide much utility as a predictive model, it does identify which variables have the strongest predictive value (see Appendix D).

The study went on to find that implementation of the patient automated reminder technology at the start of FY 01 yielded a statistically significant reduction in the overall clinic no-show rate by year's end. The reduction from 8.65% in FY 00 to 7.60% in FY 01 resulted in a X^2 (1) = 7.24, $p < .05$ (see Appendix E).

Discussion

Analysis of appointment keeping behavior within this particular sample provides some interesting insight into which factors may influence a clinic's no-show rate while identifying ways to increase efficiency. Although there is no literature indicating how low a healthcare organization can drive down their no-show rate, or no single, best benchmark that offers the most ambitious organizations a target to strive for, the fact remains, healthcare organizations must understand the unique characteristics that affect full optimization of their service lines. It is important to note that if comparisons are to be made, and conclusions regarding clinic efficiency are to be drawn, Brooke Army Medical Center's Family Medicine Services has achieved a desirable show to no-show rate. Even so, much like any other organization striving to reduce cost and improve the quality and availability of service provided, there must always be a desire to continuously improve. In order to realize such improvements an organization must remain intimately familiar with the population they serve and the processes involved in delivering that service.

Demographic Characteristics

Analysis of appointment keeping behavior as it relates to patient age revealed that patients, age 45 or older were responsible for 44% of all no-shows while, as a group, they were responsible for 62% of actual appointments seen within the clinic. This becomes important when compared to patients age 18-34 who registered 34% of the no-shows and only 18% of the appointments made. This is consistent with the relationship between older retired military and their dependents/survivors who accounted for 52% of the no-shows and 66% of the clinic visits, while the younger active duty service member and

their dependents accounted for a disproportionate 47% of the no-shows and only 32% of the made appointments.

Clearly this is an alarming statistic given the fact that the younger population, who are relatively healthy now and utilize healthcare services far less, will in the not too distant future require more services as they age and become more dependent on the Military Healthcare System. Various hypotheses can be generated to help explain this phenomenon. For example, the younger population could be engaged in a wider array of competing priorities that prevent them from making scheduled appointments. On the other hand, and probably the most threatening explanation, is that the younger population may ascribe to a different set of values than the older population, regarding health care services as an infinite resource.

Also achieving statistical significance in both the univariate and multivariate analysis was marital status. Single, unmarried or divorced beneficiaries were shown to have a higher propensity for missed appointments. These individuals were responsible for only 17% of the made appointments and a disproportionate 23% of the no-shows.

Military branch of service, similar to the above-mentioned variables, achieved statistical significance using both univariate and multivariate analysis. Results revealed that service members, dependents or retired military/survivor belonging to a particular branch of service other than the Air Force were more likely to miss a scheduled clinic visit. With the exception of the Marine Corps, the Army, Navy and Other (Coast Guard, NOAA, and Public Health Service) branch classification were shown to have a disproportionate percentage of no-shows to made appointments. What this reveals is that our ability to provide services to non-Army beneficiaries may actually improve our

efficiency, suggesting Service cultural differences have an effect on appointment non-adherence.

Enrollment to the MTF for which an appointment was scheduled was also found to be a factor affecting no-show behavior. Non-Tricare Prime beneficiaries who either elect to receive care through the managed care support contractor's network of providers, or are forced to do so as a result of capacity limitations, are seen at the clinic on a space available basis. Often these individuals are forced to accept appointments that are outside the pre-described access standards which result in a longer than usual call to appointment interval. It is not known whether it is the patient's relationship to the facility or the delay in treatment which have the greatest effect on no-show behavior within this group, nevertheless, a suitable explanation will become a more pressing issue as MTF's try to recapture network care and attract beneficiaries back to the Military Healthcare System.

Next, where a patient lives in relation to the predefined service or "catchment" area boundary offered some interesting insight into appointment non-adherence. The catchment area is defined as a geographic area comprised of a set of five (5) digit zip codes that circumscribe the facility and extends out approximately forty (40) miles in all directions. The study found that patients residing outside the catchment area had a no-show rate of approximately 12%. Although the number of patients seen from outside the defined service area is small in comparison, this finding reaffirms the need to constantly evaluate and validate the time and distant patients are expected to travel to obtain non-emergent healthcare services.

Clinic Scheduling Characteristics

Understanding the patient specific characteristics that influence appointment non-adherence will provide decision makers with pivotal information from which appropriate appointment templates will be designed. However, once this analysis has been completed their attention must then focus on the internal processes involved in patient scheduling. The day of the week and the call to appointment interval are two such scheduling characteristics that are completely under the control of clinic administrators. For example: ask any clinic administrator which two days of the week offer the least amount of scheduling predictability and they will most likely tell you Monday and Friday. As a percentage, the results of this study support this intuitive hunch. Correcting for this phenomenon may require the establishment of a separate template for these two days; one that offers the clinic more flexibility to accommodate a greater number of same day or acute appointments.

In addition, the research supports the adoption of an open access model within the primary care service line at BAMC. Descriptive statistics revealed a declining rate of appointment keeping, which reached a high of 95.5% in the next day group, and declined to 92.6% and 91.4% in the 2-6 day group and 7-13 day group, respectively. This finding is supported by the literature, which points to open access as a potential cure for escalating no-show rates and a means for improving clinic efficiency.

Patient Appointment Reminder System

In September of 1999, Headquarters, Great Plains Regional Medical Command (GPRMC) funded acquisition of the Patient Appointment Reminder System (PARS) for Brooke Army Medical Center, as well as five other facilities within GPRMC's

geographic area of responsibility. Following a lengthy contract protest the system was delivered and installed at BAMC during the end of June 2000. This acquisition strategy clearly focused the Command's efforts on improving clinic efficiency and reducing the effects of appointment non-adherence within family medicine services, as well as several other high volume outpatient services offered at MTFs throughout the region. The system provided for an automated interface to the Composite Health Care System (CHCS), the hospital's internal clinical database capable of extracting a daily list of appointments and then calling the patients to remind and confirm their scheduled appointments. An after contact report could then be generated and could be sent to the clinics/physicians for which an appointment was scheduled.

The system provided for a detailed analysis of the contacts, and provided error analysis as to why the contact was not made, (e.g. wrong SSN, wrong telephone number, etc) so that the clinical databases could be corrected as necessary. Assuming the number of scheduled appointments (non-walk-ins or same-day appointments) were approximately 60% of all appointments, and each facility would be sending automated reminders 23 days per month (Monday – Friday) from 5:30 p.m. to 9:30 p.m., with each call lasting approximately 1 minute, 30 seconds, the following forecast was developed for six facilities within GPRMC:

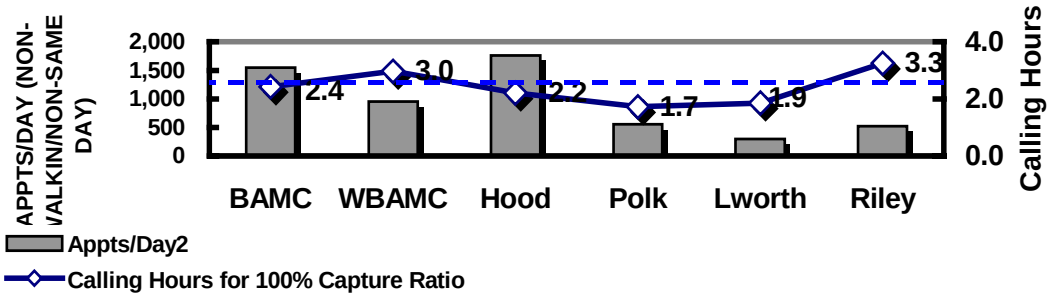

Figure 1. Calls per day and calling hours for 100% capture.

Based on these assumptions Brooke Army Medical Center could contact 100% of their beneficiaries with scheduled appointments two days in advance within 2.4 hours. The PARS system is comprised of a Pentium II, 450 MHz microprocessor with 128 MB RAM, 8+GB HDD, 10/100 full duplex NIC, 17" Sony monitor, 32X CD-ROM, internal fax/modem, 3.5" Diskkeeper for WIN NT, and a Deerfield FTP Server. The total cost to purchase this technology for BAMC included a one-time sunk cost of $24,505 with an annual variable maintenance cost of $4,995.

Analysis of the effectiveness of this technology yielded a 12% reduction in the overall clinic no-show rate at the end of FY01 (7.60%) compared to FY00 (8.65%). In addition the facility saw its percentage of appointments cancelled by the facility drop from 5.61% in FY00 to 3.37%, a 40% reduction which proved to be statistically significant, X^2 (1) = 57.98, $p < .001$. This reduction points to an improved level of predictability within the scheduling system, which can be at least partially credited to the acquisition and deployment of PARS (see Appendix E).

Although first year performance provided some encouraging results the financial assessment raised some questions regarding the profitability of the purchasing decision. It was determined that the implementation of PARS resulted in approximately 58 fewer no-shows within the FMS clinics for the entire fiscal year. MEPRS determined that each of these visits cost the clinic $111.10 (FY00). Based on these two figures the net sum cost avoidance for FY01 was approximately $6,385. On the surface, this also looks encouraging given the fact that the project covers its variable maintenance cost ($4,995) and has a positive annual contribution margin of $1,390. However, at this rate the project

doesn't break-even until the eighteenth year (18th) and doesn't achieve a positive net return on investment until the forty-third (43rd) year (based on a constant dollar discount rate of 3.20%, published by the Cost and Economic Analysis Center, Headquarters Department of the Army).

When interpreting these results the reader should be cautioned about making snap assumptions based on first year performance. To make a valid assessment of this purchasing decision it is recommended that the reader consider two important factors. First, determine the social value of this service, measured by improved patient perception regarding quality and service. Secondly, can the management of this technology be improved to yield significantly higher results? For example: a second financial scenario analysis was performed based on a reduction rate of 2% or 110 less no-shows per year. In this scenario the project has a four-year payback period and provides a positive net return on investment within four years, which is well within the practical service life of this technology. Given the sheer number of appointments scheduled within the two FMS clinics each year, as well as the number of no-shows, this target should be considered less than ambitious. In addition, this financial analysis allocates all costs associated with the purchase of this technology to one particular service line, when in fact several other outpatient clinics use this technology to manage the effects of no-shows. Therefore, further analysis is needed to determine the financial contribution margin of all clinics within BAMC utilizing this system.

While opportunities abound for this new technology, one recent technological advance may hinder full PARS optimization and threaten its future usefulness. The advent and use of home privacy technology by BAMC customers may prevent automated

patient reminders from reaching their intended destination. The popularity of these new devices is beginning grow in response to the ever growing number of unsolicited telemarketing calls made to personal residences. This privacy technology targets call center computers that utilize an auto dialer or predictive dialer to call consumers. Once a call is received at a home equipped with this device it emits a special tone that fools the computer into thinking the number its trying to call has been disconnected. Therefore, daily-generated contact reports may indicate a patient's home phone number is incorrect, when in actuality it is not. BAMC has struggled with lower than expected contact rates for the last year, but has been unable to ascertain if the root cause is inaccurate information in the CHCS database or privacy technology.

This study has outlined several patient demographic and clinic scheduling characteristics that influence appointment non-adherence. Armed with this information the clinic can now develop a patient profile that suggests which type of beneficiary is most likely to no-show for a scheduled appointment. This should prompt marketing and education efforts aimed at enlightening specific groups of beneficiaries on the importance of either canceling appointments in advance, or showing up for their scheduled clinic visits. This could be accomplished with something as simple as a friendly letter to the beneficiary, which explains how no-shows affect the clinic's ability to provide timely access, and the process to follow in the event they need to cancel a future scheduled appointment.

If the organization believes this action will unnecessarily target individuals that don't have a problem making it to the clinic, then a second more focused approach should be considered. For example: analysis of the FY 00 dataset revealed that 2,471 individuals

scheduling appointments with FMS were responsible for the 3,069 no-shows that year, or 1.24 no-shows per individual. For further clarification consider the following table:

Table 2

Patient No-Shows (Repeat Offenders)

# Of No-Shows	# Of Beneficiaries	Total Missed by Group	% Of Total No-Shows
1	1986	1986	64.71%
2	*401*	*802*	26.13%
3	*61*	*183*	5.96%
4	*19*	*76*	2.48%
5	*3*	*15*	0.49%
6	*0*	*0*	0.00%
7	*1*	*7*	0.23%
Total	2471	3069	100.00%

From the above table it is easy to see that targeted programs focusing on the 485 repeat offenders with two or more no-shows within a given time period may be the most appropriate and least intrusive method for curbing negative appointment keeping behavior. Furthermore, those beneficiaries with four or more no-shows may require a call from a clinical case manager to determine if there are actionable clinical or social reasons for multiple missed appointments. For example, the patient has diabetes and due to poor control, frequently feels too sick to make previously scheduled appointments.

Conclusions and Recommendations

In summary, this research demonstrated that both patient demographic and clinic scheduling characteristics could be used to identify statistically significant univariate correlates of appointment keeping behavior within specific subgroups of the beneficiary population. Multivariate analysis was then able to show that age, beneficiary category, sponsors branch of service and marital status provided the most utility in the development

of a predictive model. Although the model developed here only explains a small percentage of the variance, it should provide a point of debarkation for future studies.

Furthermore, the study went on to find that implementation of an automated appointment reminder system yielded a statistically significant reduction in the overall clinic no-show rate. This finding demonstrates the usefulness of this technology as a means for minimizing the effects of appointment non-adherence and optimizing clinic efficiency.

In an effort to improve predictive accuracy, the researcher recommends that future studies attempt to isolate prior appointment keeping behavior as an independent variable within the model. It is believed that inclusion of this variable, along with another measure, that isolates the patient's perception regarding the urgency of their medical problem, will strengthen the overall utility of a predictive model. Thus, improving its confidence interval and its value to decision makers.

In the interim, the automated patient reminder system has demonstrated its effectiveness as a tool to reduce patient no-shows and improve access. Financial analysis has also indicated a net cost avoidance and thus, a positive contribution margin. However, the organization should make every attempt to optimize the effectiveness of this technology during what appears to be its relatively short service life. It is hoped that this research endeavor will significantly add to the body of knowledge available to healthcare administrators as they strive to improve access by creating additional capacity, recapturing costs and improving patient satisfaction.

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Appendix A

Dependent & Independent Variable Codebook.

Dependent Variable	**Construct**	**Unit of Measure/(Code)**
Appointment Status	Dichotomous	Show (1), Otherwise (0)
Independent Variables		
Patient Age	Continuous	Years of Age
Gender	Dichotomous	Male (1); Female (0)
Marital Status	Dichotomous	Married (1); Otherwise (0)
Beneficiary Category	Discrete	AD MIL (1); DEPN AD MIL (2) RET MIL (3); DEPN RET/SURV (4) Other (5)
Tricare Prime	Dichotomous	Yes (1); Otherwise (0)
Resides within Catchment Area	Dichotomous	Yes (1); Otherwise (0)
Sponsors Branch of Service	Discrete	Army (1); Air Force (2); Navy (3)
Appointment Day of the Week	Discrete	Monday (1); Tuesday (2) Wednesday (3) Thursday (4); Friday (5)
Call-Appt Interval	Discrete	Next Day (1); 2-6 Days (2); 7-13 Days (3); 14-20 Days (4); 21-27 Days (5); 28+ Days (6)

Appendix B

Descriptive Statistics of the Outcome and Predictor Variables.

			Kept Appt	Missed Appt	Total	% No-Show
Dependent Variable						
Appointment Status			35,484	3,069	38,553	8.65%
Independent Variables						
Age	0-4		145	16	161	11.03%
	5-14		529	45	574	8.51%
	15-17		373	48	421	12.87%
	18-24		2,487	491	2,978	19.74%
	25-34		4,106	556	4,662	13.54%
	35-44		5,739	555	6,294	9.67%
	45-64		14,788	934	15,722	6.32%
	65+		7,317	424	7,741	5.79%
		Total	35,484	3,069	38,553	8.65%
Gender	Male		13,414	1,129	14,543	8.42%
	Female		22,070	1,940	24,010	8.79%
		Total	35,484	3,069	38,553	8.65%
Marital Status[1]	Married		13,954	986	14,940	7.07%
	Other		2,782	288	3,070	10.35%
		Total	16,736	1,274	18,010	7.61%
Beneficiary Category	AD MIL		4,935	559	5,494	11.33%
	DEPN AD MIL		6,649	871	7,520	13.10%
	RET MIL		9,843	650	10,493	6.60%
	DEPN RET/SURV		13,767	956	14,723	6.94%
	OTHER		290	33	323	11.38%
		Total	35,484	3,069	38,553	8.65%
Tricare Prime	Yes		34,186	2,925	37,111	8.56%
	No		1,298	144	1,442	11.09%
		Total	35,484	3,069	38,553	8.65%
Within Catchment Area	Yes		34,265	2,916	37,181	8.51%
	No		1,219	153	1,372	12.55%
		Total	35,484	3,069	38,553	8.65%
Sponsors Branch of Service	Army		22,855	2,245	25,100	9.82%
	Air Force		10,643	650	11,293	6.11%
	Navy		1,340	123	1,463	9.18%
	Marine		525	38	563	7.24%
	Other		121	13	134	10.74%
		Total	35,484	3,069	38,553	8.65%
Appointment Day of the Week	Monday		7,573	669	8,242	8.83%
	Tuesday		7,467	666	8,133	8.92%
	Wednesday		5,876	481	6,357	8.19%
	Thursday		7,382	548	7,930	7.42%
	Friday		7,186	705	7,891	9.81%
		Total	35,484	3,069	38,553	8.65%
SAIC DATA SOURCE[2]						
Dependent Variable						
Appointment Status			13,815	1,004	14,819	7.27%
Independent Variable						
Call-Appointment Interval	Next Day		5,121	242	5,363	4.73%
	2-6 Days		3,005	239	3,244	7.95%
	7-13 Days		2,735	256	2,991	9.36%
	14-20 Days		1,639	146	1,785	8.91%
	21-27 Days		1,020	93	1,113	9.12%
	28+ Days		295	28	323	9.49%
		Total	13,815	1,004	14,819	7.27%

[1] Total does not add up to 38,553 as a result of missing data
[2] The SAIC data file excludes BAMC's satellite clinic

Appendix C

The Univariate Relationship Between No-Show Behavior and Patient Demographic and Clinic Scheduling Patterns

Patient Demographic Characteristics		*Patient Behavior* *Show (N %)*	*No-Show (N %)*	X^2
Age	0-4	145 (.41)	16 (.52)	562.28 (df = 7)*
	5-14	529 (1.49)	45 (1.47)	
	15-17	373 (1.05)	48 (1.56)	
	18-24	2,487 (7.00)	491 (16.00)	
	25-34	4,106 (11.57)	556 (18.12)	
	35-44	5,739 (16.17)	555 (18.08)	
	45-64	14,788 (41.68)	934 (30.43)	
	65+	7,317 (20.62)	424 (13.82)	
Gender	Male	13414 (37.80)	1129 (36.79)	1.24 (df = 1)
	Female	22070 (62.20)	1940 (63.21)	
Marital Status[1]	Married	13954 (83.38)	986 (77.39)	29.97 (df = 1)*
	Other	2782 (16.62)	288 (22.61)	
Beneficiary Category	AD MIL	4935 (13.91)	559 (18.21)	261.57 (df = 4)*
	DEPN AD MIL	6649 (18.74)	871 (28.38)	
	RET MIL	9843 (27.74)	650 (21.18)	
	DEPN RET/SURV	13767 (38.80)	956 (31.15)	
	OTHER	290 (.82)	33 (1.08)	
Tricare Prime	Yes	34186 (96.34)	2925 (95.31)	8.39 (df = 1)*
	No	1298 (3.66)	144 (4.69)	
Within Catchment Area	Yes	34265 (96.56)	2916 (95.01)	19.77 (df = 1)*
	No	1219 (3.44)	153 (4.99)	
Sponsors Branch of Service	Army	22855 (64.41)	2245 (73.15)	110.15 (df = 4)*
	Air Force	10643 (29.99)	650 (21.18)	
	Navy	1340 (3.78)	123 (4.01)	
	Marine Corps	525 (1.48)	38 (1.24)	
	Other	121 (.34)	13 (.42)	
Appointment Day of the Week	Monday	7573 (21.34)	669 (21.80)	24.34 (df = 4)*
	Tuesday	7467 (21.04)	666 (21.70)	
	Wednesday	5876 (16.56)	481 (15.67)	
	Thursday	7382 (20.80)	548 (17.86)	
	Friday	7186 (20.25)	705 (22.97)	
SAIC DATA SOURCE[2]				
Call-Appointment Interval	Next Day	5121 (37.07)	242 (24.10)	72.15 (df = 5)*
	2-6 Days	3005 (21.75)	239 (23.80)	
	7-13 Days	2735 (19.80)	256 (25.50)	
	14-20 Days	1639 (11.86)	146 (14.54)	
	21-27 Days	1020 (7.38)	93 (9.26)	
	28+ Days	295 (2.14)	28 (2.79)	

[1] Total does not add up to 38,553 as a result of missing data
[2] The SAIC data file excludes the satellite clinic
*P < 0.001

Appendix D

Predictive Model Regression Coefficients

		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model		B	Std.	Beta		

			Error			
1	(Constant)	.934	.002		478.385	.000
	YRS18_24	-9.357E-02	.009	-.078	-10.458	.000
2	(Constant)	.938	.002		460.792	.000
	YRS18_24	-9.780E-02	.009	-.081	-10.922	.000
	YRS25_34	-5.084E-02	.007	-.054	-7.202	.000
3	(Constant)	.940	.002		450.493	.000
	YRS18_24	-8.981E-02	.009	-.075	-9.857	.000
	YRS25_34	-3.670E-02	.008	-.039	-4.777	.000
	DEPN_AD	-2.960E-02	.006	-.038	-4.661	.000
4	(Constant)	.935	.003		354.947	.000
	YRS18_24	-8.633E-02	.009	-.072	-9.417	.000
	YRS25_34	-3.352E-02	.008	-.035	-4.332	.000
	DEPN_AD	-2.800E-02	.006	-.036	-4.398	.000
	AIR_FORC	1.368E-02	.004	.025	3.352	.001
5	(Constant)	.921	.005		179.887	.000
	YRS18_24	-7.819E-02	.010	-.065	-8.206	.000
	YRS25_34	-3.257E-02	.008	-.034	-4.207	.000
	DEPN_AD	-2.997E-02	.006	-.039	-4.685	.000
	AIR_FORC	1.324E-02	.004	.025	3.242	.001
	MARITAL	1.647E-02	.005	.024	3.126	.002

Dependent Variable: Appointment Status (Coded 1 for Show, 0 for No-Show)

Model Summary

	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
Model					R Square Change	F Change	df1	df2	Sig. F Change
1	.078	.006	.006	.256	.006	109.372	1	18008	.000
2	.094	.009	.009	.255	.003	51.871	1	18007	.000
3	.100	.010	.010	.255	.001	21.727	1	18006	.000
4	.103	.011	.010	.255	.001	11.234	1	18005	.001
5	.106	.011	.011	.255	.001	9.772	1	18004	.002

1. Predictors: (Constant), YRS18_24
2. Predictors: (Constant), YRS18_24, YRS25_34
3. Predictors: (Constant), YRS18_24, YRS25_34, DEPN_AD
4. Predictors: (Constant), YRS18_24, YRS25_34, DEPN_AD, AIR_FORC
5. Predictors: (Constant), YRS18_24, YRS25_34, DEPN_AD, AIR_FORC, MARITAL

Appendix E

Statistical Significance of PARS Implementation (FY 00 to FY 01)

	FY00		**FY01**	
Total Visits (Show)	35,484		72,558	

Appointment Status		**Rate**		**Rate**	**X^2**	**P value**
No-Show	3,069	8.65%	5,517	7.60%	7.24 (df = 1)	< .05
Cancelled by Facility	1,992	5.61%	2,445	3.37%	57.98 (df = 1)	< .001